RMO

UNITED STATES DEPARTMENT OF AGRICULTURE

FOREST SERVICE

IMPACT ON ANTELOPE AND DEER SAGEBRUSH RANGES BY THE SAGEBRUSH DEFOLIATOR - *Aroga websteri*

By

Ralph C. Hall
Division of Timber Management, U. S. Forest Service
San Francisco, California 94111

Annex 1
SB
608
S32 H3
1964

U. S. DEPARTMENT OF AGRICULTURE
FOREST SERVICE
CALIFORNIA REGION
1964

6200-7

U. S. GOVERNMENT PRINTING OFFICE

16—73806-3

Detection

5220

January 20, 1964

IMPACT ON ANTELOPE AND DEER SAGEBRUSH RANGES BY THE SAGEBRUSH DEFOLIATOR - *Aroga websteri*

By

Ralph C. Hall [1/]
Division of Timber Management, U. S. Forest Service
San Francisco, California 94111

Introduction

According to A. A. Beetle (1960) there are about 270 million acres of sagebrush in the Western United States, with an estimated 18 million acres in California. (Figure I) Sampson and Jesperson (1963) state, "Sagebrush is an exceedingly important food plant for the Rocky Mountain mule deer and for antelope. On the interstate winter range in northern California, it accounted for an average of 19 percent of the Rocky Mountain mule deer diet. In California, big sagebrush proved to be a staple food for the prong-horn antelope throughout the year according to stomach analyses. The degree of utilization by these animals was as follows: 95.2 percent by volume in December; 40.8 percent in May and June; and 35.9 percent in August and September."

Extensive areas of sagebrush are currently being threatened by the sagebrush defoliator, *Aroga websteri* Clarke in many of the western States. This may have a serious impact on the carrying capacity of many sagebrush ranges, particularly those used by deer and antelope during the critical winter months.

There is practically no published information on the sagebrush defoliator except for an article by Clarke (1942) when he described this species from specimens collected at Pullman, Washington. Henry (1961) has a fairly comprehensive unpublished manuscript on the biology of this insect in Idaho.

Distribution of the Insect

The sagebrush defoliator has been reported from the States of California, Idaho, Montana, Nevada, Oregon, Utah, and Washington. Since it is a native insect it probably occurs in other western States where sagebrush is abundant.

1/ Paper presented at the Interstate Antelope Conference, Alturas, California. December, 1963.

Host

In California, we have reared the sagebrush defoliator from the following species of sagebrush: Artemisia arbuscula, A. tridentata, and A. cana. In Idaho, Henry (1961) reports rearing from these three species, plus A. nova, A. tripartita and A. longiloba. In addition, in California we have a single record from rabbit brush, Chrysothamnus nauseosus and bitterbrush, Purshia tridentata. We believe that sagebrush is the principal host for this insect and that it feeds on other species only under conditions of extreme stress. In both of the above exceptions, bitterbrush and rabbit brush made up less than one percent of the cover in areas where the sagebrush was almost completely defoliated.

Description

The adult of the sagebrush defoliator is a small grey moth with a wing expansion of 14 to 16 mm., about the size of a clothes moth. There is considerable variation in the color of the moths, but generally they are a smoke color with black markings on the front wing. (Figure II-A) Henry (1961) describes the eggs as "globular to elongate oval, ends equally round, approximately 0.45 mm. wide to 0.60 mm. long. somewhat flattened on central surface at the point of attachment to plant tissues--almost transparent white when first laid, turning to a pearly white shortly after, becoming yellow to orange-gold prior to eclosion." I have never observed an egg. The mature larvae are about 12 mm. in length with a dark brown head and a creamy-white body, with a row of black spots on each side of the abdomen. (Figure II-B)

Biology and Habits

The sagebrush defoliator has a one-year-life cycle. Limited information of life history in California indicates that adults start emerging in early July and emergence is completed by late August. This is in close agreement with Henry's (1961) findings in Idaho. Henry (1961) reports that the eggs are deposited on the bark of the stems of the sagebrush plants about ten days after female emergence. These eggs hatch in about one month.

The newly hatched larvae migrate to the foliage where they mine into a leaf and overwinter. Early in the spring they become free feeding. They work up and down the stem and clip off the leaves next to the stem. These are webbed together with silk and remain attached to the stem until late fall when rains remove most of them.

The adults are active only at night. According to Ritcher (1963) thousands of Aroga moths were attracted to black light traps in eastern Oregon in the summer of 1963. In our rearing work at Hat Creek, we found that the moths did not come to ordinary light.

Evidence of Defoliation

Since the severed leaves still remain webbed together on the stems, the only evidence of attack from a distance is the change in color from sage green to ash grey of the defoliated plants. Upon close examination, the evidence of webbed leaves is very characteristic of damage. (Figure III)

History of Outbreaks

The first report I could find on damage to sage by Aroga is that by Funk (1954) when he reported spotty feeding in northern Nevada near the Oregon border in 1949. Funk carried on rather detailed observations on this insect in Nevada, Oregon and to a limited extent in California through 1954. From his notes it appears that Aroga was in high outbreak proportions from 1951 through 1953. During this outbreak some mortality to sagebrush was reported in the Doyle-Hallelujah area in California. I could find no further reports on damage after 1954, so it is presumed that the outbreak subsided.

The next report which came to our attention in California was a cooperative detection report of serious local damage to sagebrush in northeastern California and northwestern Nevada submitted by Dick Hubbard from the Pacific Southwest Forest and Range Experiment Station, late in July 1962. I checked these areas in August 1962 and again in July 1963 and found a tremendous increase in the area of infestation and degree of defoliation. A similar situation apparently developed during the same interval in Oregon. We appear to be experiencing another extensive outbreak which will probably persist for a year or two.

Extent of Damage to Sagebrush

Most of the information on damage to sagebrush by Aroga is based upon general observations and I know of no precise data on this subject. In the Biennial Report of the State of Nevada, State Department of Agriculture, for the years July 1, 1948 - June 30, 1950; July 1, 1950 - June 30, 1952; and July 1, 1952 - June 30, 1954 it is stated, "In areas that were severely damaged in 1949, 75 percent of the sagebrush is completely dead. Many thousand acres of sagebrush have been killed (in Nevada) while many additional acres have been seriously injured."

Funk (1950) states, "Damage to sagebrush in all the areas the writer has traveled over is extensive and heavy, estimated at about 90 percent damage to 90 percent of the sagebrush. The area reaches from Highway 395 to Highway 95 along all roads traveled in between and as far north as 30 miles north of Hart Mountain Game Refuge and Sheep Mountain."

Funk (1954) for 1951 states, "Heaviest infestation observed in southern Oregon and northwestern Nevada is a strip from Highway 95 to Highway 395, and about 70 miles wide in Oregon, and a strip in northwestern Nevada south from the Oregon line for 50 miles and east from the California line to Quinn River Crossing. Would estimate this area would have an average of 60 percent of the sagebrush dead and the infestation almost solid."

Schweis (1952) states, "The (Aroga) infestation is widespread, and much of the so-called big sagebrush, Artemisia tridentata has been killed outright while other plants have been seriously damaged (in Oregon)."

Gates (1963) states, "Last year several thousand acres of sagebrush in Malheur, Harvey and Lake Counties were observed to be heavily infested and seemingly dead or dying. Follow-up checks this summer confirmed destruction of sagebrush in these areas. In fact, the rangeland appears to have had a very successful spray job with 2,4-D. What's more, it didn't cost a cent." He further states, "The Bureau of Land Management and Oregon State University range specialists conservatively estimate the rangelands ravaged by the defoliating moth extend over an area of six to seven million acres in Oregon." The Bureau of Land Management estimates an additional six million acres defoliated in the State of Washington.

My own observations in northwestern Nevada and northeastern California indicate that from 50 to 75 percent of the sagebrush has been killed in 1963 in areas heavily defoliated in 1962, and more than 1 million acres of sage was heavily defoliated in California in 1963. No estimates are available for Nevada, but based on the situation in northwestern Nevada near the California border, extensive areas are affected in that State.

Range Management Implications

In discussing the management implications of the current infestation, Gates (1963) states, "The overall effects of the moth have tremendous range improvement and management implications. The sagebrush kill (by Aroga) appears to be equivalent to a $75,000 spray job, but the full effects of the insect cannot be accurately determined as yet. If the "kill" is permanent, then those concerned with range improvement should be planning to take advantage of a favorable situation." While this may be a favorable situation, so far as the cattlemen are concerned, it may develop into a disastrous situation for the game manager.

One of the most serious implications, as I see it, is the drastic reduction in the carrying capacity of certain local ranges where Aroga has killed a high percentage of the sagebrush in the matter of a year or two. This would be particularly critical in wintering range for deer and antelope.

One big unknown in the current situation is the species of plants which will naturally replace the dead sagebrush. There is some indications that the succeeding plants will be much less desirable than sagebrush for browse.

Need for Additional Information

Except for the biology of Aroga there is very little precise information on this insect. Practically nothing is known about its ecology. Some of the unanswered questions are: 1. How many years of defoliation will sagebrush take before mortality occurs? 2. How important is refoliation in late summer following defoliation? 3. What is the effect of plant vigor on defoliation and subsequent damage or mortality? 4. What is the plant succession following mortality? 5. What is the effect on the carrying capacity of the range following heavy defoliation? 6. What is the extent of serious damage to sagebrush in the current outbreak? 7. How does climate affect the abundance of Aroga? 8. Can this insect be used as a management tool in control of sagebrush? These are just some of the questions which occur to me. As game managers, you may think of additional ones.

Prospect for the Future

The history of most defoliators is that they periodically reach explosive numbers and may cause serious damage to the host plant for a short period of time. Generally an outbreak is brought under control by parasites and predators, after which time the defoliator populations are reduced to a very low level and remain at an endemic level for some time. We expect the Aroga infestation to follow this general pattern. Ritcher (1963) found parasitism ranged from 50 to 70 percent in rearings from 75 samples of sagebrush from Oregon this season. In California we found parasitism to be generally high in all rearings but we do not have percentage figures.

Our best guess is that the present outbreak may persist for a year or two, when it will be brought under control by parasites and predators. We do not expect that sagebrush will be completely eliminated over most areas but expect rather that heavy mortality will be restricted to local areas.

Other Insects Affecting Sagebrush

In his rearing work in Oregon, Ritcher (1963) found a leaf miner Bucculatrix tridenticola associated with Aroga in Oregon. In our California rearing, we found the same insect to be very common but have no information on the relative importance of the two species. Pringle (1955) reported the larvae of a Chrysomelid beetle, Trirhabda pilosa causing serious local damage to big sagebrush near Kamloops, British Columbia. We have not found this insect in California. Ritcher (1963) also found small numbers of a third species of moth which has not yet been determined.

Literature Cited

1. Beetle, A. A., 1960. A Study of Sagebrush, the Section Tridentatae of Artemisia. University of Wyoming Agricultural Experiment Station. Bulletin 368: 1-83.

2. Biennial Report of Nevada State Department of Agriculture, July 1, 1948 - June 30, 1950.

3. Biennial Report of Nevada State Department of Agriculture, July 1, 1950 - June 30, 1952.

4. Biennial Report of Nevada State Department of Agriculture, July 1, 1952 - June 30, 1954.

5. Funk, E., 1954. Information on Range Insects. Unpublished Field Notes in Nevada State Department of Agriculture file on the sagebrush defoliator.

6. Clarke, J. F. G., 1942. Notes and New Species of Microlepidopterus from Washington State Proc., U. S. National Mus. 92: 273-274.

7. Gates, Dillard H., 1963. Science's Newest Sagebrush Removal Weapon. Western Livestock Journal, October.

8. Henry, John E., 1961. The Biology of Sagebrush Defoliator, Aroga websteri Clarke in Idaho. Unpublished M.S. Thesis, University of Idaho.

9. Pringle, W. L., 1955. A New Look at Sagebrush Control, Report of Annual Meeting, Pacific Northwest Sect., American Society of Range Management, November 28-29, 1955.

10. Ritcher, Paul O., 1952, Oregon State University. Correspondence with W. J. Anderson, U. S. Department of Interior, Portland, Oregon.

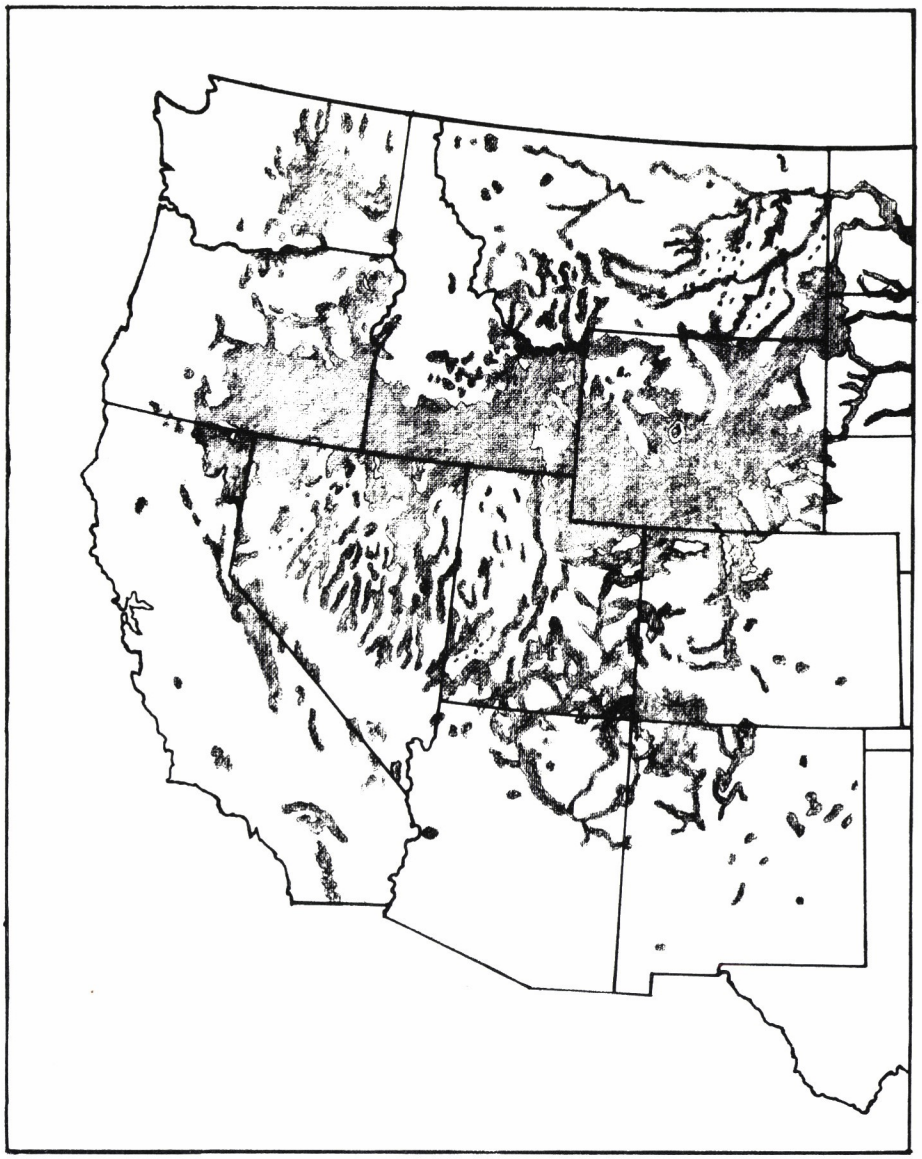
11. Ritcher, Paul O., 1963. Oregon State University correspondence with R. C. Hall, U. S. Forest Service.

12. Sampson, A. W. and Jespersen, B. S. 1963. California Range Brushlands and Browse Plants. California Agricultural Experiment Station Extension Service, Manual 33: 1-162.

13. Schweis, George G., 1952. Director, Division of Plant Industry, Nevada. Correspondence with P. O. Ritcher, Oregon State University.

Attachments (3)

Attachment 1
1/20/64



DISTRIBUTION OF SAGEBRUSH IN WESTERN UNITED STATES

(From A. A. Beetle 1960)

Attachment 2
1/20/64

A

B

Figure II

Aroga websteri, A - Adult, B - Larva x 7

By

Bureau of Entomology, Dept. of Agriculture
State of California

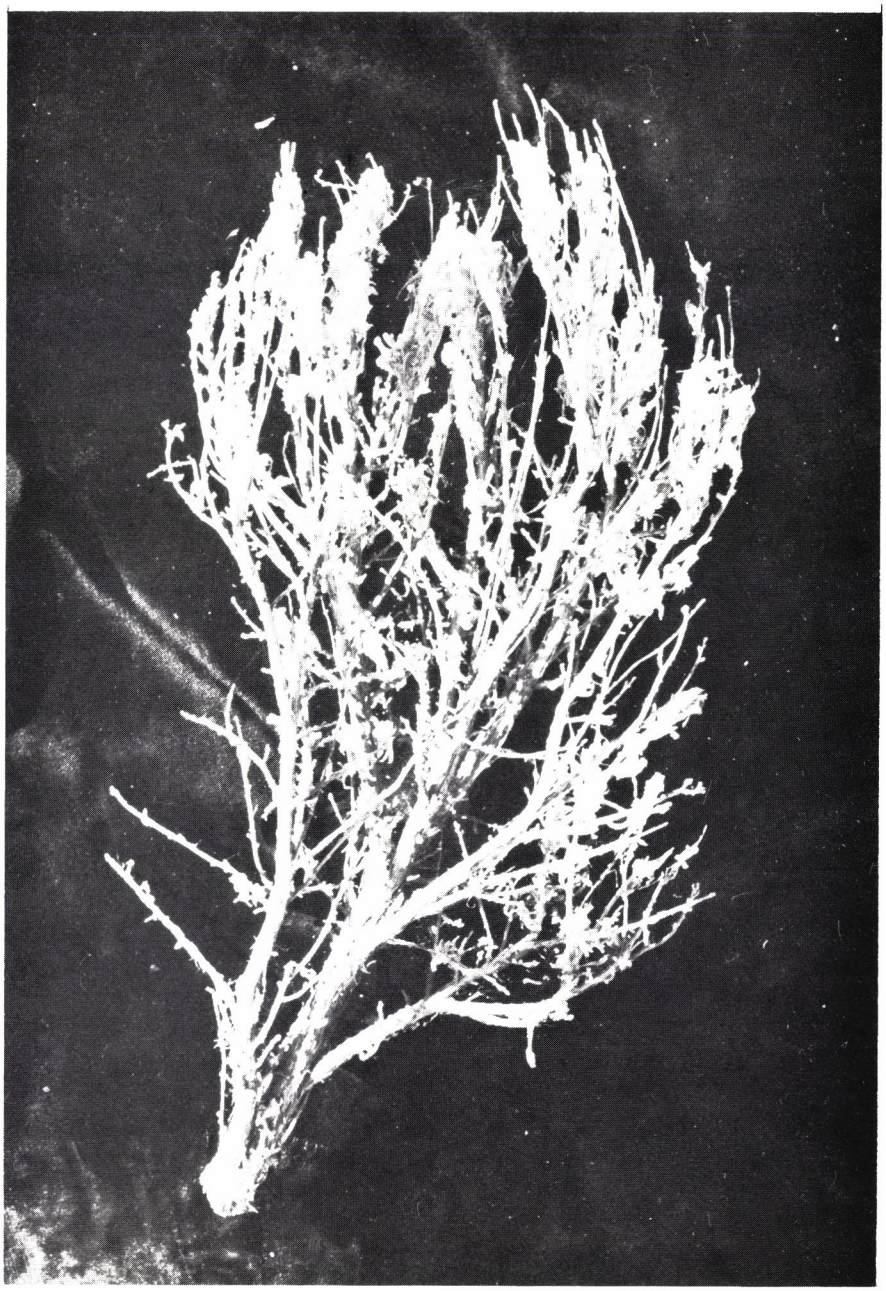


Figure III

A sagebrush plant completely defoliated by Aroga websteri showing the webbing of severed leaves, which is a characteristic symptom of defoliation.